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(54) Radiation sensitive composition adapted for roller coating

(57) A radiation sensitive composition adapted for roller coating is disclosed, wherein a solvent is a mixed solvent including 20% by weight or less of propylene glycol and/or dipropylene glycol to whole solvent. This composition forms less uneven coating upon being coated on a substrate by roller coating. As a solvent other than propylene glycol and dipropylene glycol, propylene glycol monomethyl ether acetate, propylene glycol monomethyl ether, ethylene glycol monoethyl ether acetate, propylene glycol t-butyl ether, and ethyl lactate are preferred.

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Description

Background of the Invention

This invention relates to a radiation sensitive composition adapted for roller coating and, more particularly, to a radiation sensitive composition which can provide a resist layer with scarcely forming uneven coating when coated by roller coating method.

In manufacturing semiconductor integrated circuit elements, color filters, liquid crystal display elements, etc., lithographic technique has conventionally been employed for conducting fine work. In recent years, techniques enabling fine work on the order of sub-micron or sub-quarter micron have been investigated. In such lithographic technique, a positive- or negative-working radiation sensitive composition is coated on a substrate directly or after forming thereon an anti-reflective coating if necessary, and the coated composition is prebaked to form a radiation sensitive resist layer. Then, this radiation sensitive resist layer is pattern-wise exposed by various radiations such as ultraviolet rays, deep ultraviolet rays, electron beams, X-rays or the like, and developed to form a resist pattern. As the method for coating the radiation sensitive composition, there have conventionally been known various methods such as spin coating method, roller coating method, cast coating method, doctor coating method, dip coating method, etc. In manufacturing semiconductor integrated circuits, for example, a positive-working radiation sensitive composition is employed as a resist material and, as a coating method, spin coating method is often employed. On the other hand, in manufacturing liquid crystal display, too, a positive-working radiation sensitive composition is often employed and, as a coating method, roller coating method is employed as well as spin coating method. By the way, in the spin coating method, a resist solution dropped onto a substrate is cast in the peripheral direction of the substrate by the centrifugal force produced by the rotation of the substrate, with most of the resist solution being removed out of the periphery. The thus-removed resist solution is discarded. Thus, while this spin coating method enables one to form a resist layer of uniform thickness with ease, it has the defect that the amount of discarded resist solution is so large that it imposes high cost. On the other hand, roller coating method, which can utilize most of the resin used as a resist layer, serves to reduce manufacture cost, but has the defect that there arises uneven coating such as streaks and orange peel. For example, liquid crystal display elements manufactured using a resist layer having the coating defect of streaks provide non-uniform light areas, thus having no commercial values. Therefore, there has been required a radiation sensitive composition which does not cause uneven coating streaks.

Summary of the Invention

It is an object of the present invention to provide a radiation sensitive composition adapted for roller coating, which does not have the defects with the conventional compositions as described above and, to be specific, to provide a radiation sensitive composition which, upon being coated by roller coating method, scarcely causes uneven coating.

Other objects, features and advantages of the present invention will become apparent from the detailed descriptions of the preferred embodiments of the invention to follow.

As a result of intensive investigations, the inventor has found that the above-described objects can be attained by using, as a solvent for the radiation sensitive composition, a mixed solvent which contains 20% by weight or less of propylene glycol and/or dipropylene glycol to whole solvent, thus have completed the present invention based on the finding.

That is, the present invention is a radiation sensitive composition adapted for roller coating and having improved coating properties, which comprises using, as a solvent for the radiation sensitive composition, a mixed solvent which contains 20 % by weight or less of propylene glycol and/or dipropylene glycol to whole solvent.

Detailed Description of the Preferred Embodiments of the Invention

In the present invention, propylene glycol or dipropylene glycol is used as one component of a mixed solvent for the radiation sensitive composition. One of the reasons that unevenness upon roller coating is improved by using such solvent can be considered as follows, but not wholly clear. That is, the viscosity of propylene glycol and dipropylene glycol is much higher than the other resist solvent (at 25°C , the viscosity of propylene glycol is 43.22 cps, and the viscosity of dipropylene glycol is 77.80 cps.). So even if the solid concentration is low, it is possible to provide preferable application viscosity for a resist solution. According to this reason, a large amount of the resist solution is needed for a predetermined resist film thickness after prebaked. Namely, the resist solution, of which the concentration is less than the conventional resist solution, is applied in large quantities, the better self-leveling of the resist solution rises. The above-described reason is merely presumption of inventor, and is not to be construed as limiting the present invention.

Propylene glycol as used in the present invention are highly hygroscopic. In case the coating is conducted under a humidity of between 50 to 60% RH which is an ordinary coating atmosphere, when the concentration of propylene gly-

col is more than 20% by weight, the resist film after coating and baking tends remarkably to become clouded. When the concentration of propylene glycol is less than 5% by weight, it is difficult to improve the application properties. Therefor the concentration of propylene glycol is preferably from 5 to 20% by weight, more preferably from 5 to 15% by weight. If the coating atmosphere is 70% RH, the clouding of resist film take place at a concentration of 10% by weight of propylene glycol. So in case the concentration of propylene glycol is high, it is necessary to adjust the humidity in coating and baking atmosphere to low. On the other hand, dipropylene glycol is not so hygroscopic and no limitation concerned with addition quantity like propylene glycol.

As the solvents to be used in combination with propylene glycol or dipropylene glycol, any solvent that has conventionally been or can be used as a solvent for radiation sensitive compositions may be used. Representative examples thereof include alcohols such as methanol, ethanol, propanol, butanol, methoxypropanol, ethoxypropanol; ethylene glycol monoalkyl ethers such as ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol monobutyl ether; ethylene glycol monoalkyl ether acetates such as ethylene glycol monomethyl ether acetate, ethylene glycol monoethyl ether acetate; diethylene glycol monoalkyl ethers such as diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, diethylene glycol monobutyl ether, diethylene glycol monophenyl ether; diethylene glycol dialkyl ethers such as diethylene glycol dimethyl ether, diethylene glycol diethyl ether; propylene glycol monoalkyl ethers such as propylene glycol monomethyl ether, propylene glycol monoethyl ether, propylene glycol monopropyl ether, propylene glycol monobutyl ether; propylene glycol monoalkyl ether acetates such as propylene glycol monomethyl ether acetate, propylene glycol monoethyl ether acetate; glycol diesters such as ethylene glycol diacetate, ethylene glycol dipropionate, propylene glycol diacetate, propylene glycol dipropionate, butanediol diacetate; esters such as ethyl formate, amyl formate, methyl acetate, ethyl acetate, propyl acetate, isopropyl acetate, butyl acetate, isobutylacetate, amylacetate, isoamylacetate, ethylpropionate, butylpropionate, methylbutyrate, ethylbutyrate, butylbutyrate, methyl lactate, ethyl lactate, butyl lactate, 2-ethoxyethyl propionate, 3-ethoxyethyl propionate, 3-methoxybutyl acetate, ethyl acetoacetate: aromatic hydrocarbons such as toluene, xylene; amides such as dimethylformamide, dimethylacetamide, N-methylpyroridone; ketones such as acetone, methyl ethyl ketone, methyl propyl ketone, methyl isopropyl ketone, methyl butyl ketone, methyl isobutyl ketone, methyl pentyl ketone, methyl hexyl ketone, methyl amyl ketone, ethyl propyl ketone, ethyl isopropyl ketone, ethyl butyl ketone, ethyl isobutyl ketone, dibutyl ketone, dipentyl ketone, cyclopentanone, cyclohexanone, methylcyclohexanone, cyclooctanone; dioxane, tetrahydrofurane, and so on. Preferred solvents are propylene glycol monomethyl ether acetate (PGMEA), propylene glycol monomethyl ether (PGME), ethylene glycol monoethyl ether acetate (EGA), propylene glycol t-butyl ether (PtB) and ethyl lactate(EL). These solvents may be used alone or in combination of two or more of them.

Radiation sensitive materials to be used in the radiation sensitive composition of the present invention may be any of known or well known positive- or negative-working resist materials. Typical examples of the radiation sensitive materials to be used in the present invention include positive-working ones such as a resist comprising an alkali-soluble resin and a quinonediazide compound, a chemically amplified resist, etc. and negative-working ones such as a resist containing a photosensitive group-having high molecular compound (e.g., polyvinyl cinnamate), a resist containing an aromatic azide, or a combination of cyclized rubber and a bisazide compound, a resist containing a diazo resin, a photopolymerizable composition containing an addition-polymerizable unsaturated compound, and a chemically amplified negative-working resist consisting of an alkali soluble resin, a cross linking agent and acid generating agent.

The radiation sensitive material comprising an alkali-soluble resin and a quinonediazide compound is one of preferred materials for constituting the radiation sensitive composition of the present invention. Several examples of the alkali-soluble resin and the quinonediazide compound are illustrated below. That is, as the alkali-soluble resin, there are illustrated novolak resin, polyvinylphenol, polyvinyl alcohol, copolymers of acrylic acid or methacrylic acid, etc. The novolak resin is exemplified by a polycondensation product between one or more of phenols such as phenol, o-cresol, m-cresol, p-cresol, xylenol, trimethylphenol, t-butylphenol, ethylphenol, 2-naphthol or 1,3-dihydroxynaphthalene and an aldehyde such as formaldehyde or para-formaldehyde. These alkali-soluble resins such as the novolak resin may be used in combination of two or more, if necessary.

Examples of the quinonediazide compound include 1,2-benzoquinonediazide-4-sulfonic acid, 1,2-naphthoquinonediazide-4-sulfonic acid, 1,2-naphthoquinonediazide-5-sulfonic acid, esters or amides of these sulfonic acids, etc. The sulfonic acid esters or amides of the quinonediazides can be obtained by the condensation reaction between a corresponding quinonediazide sulfonic acid or quinonediazidesulfonyl chloride and a hydroxyl group-having compound or an amino group-having compound. As the hydroxyl group-containing compound, there are illustrated dihydroxybenzophenone, trihydroxybenzophenone, tetrahydroxybenzophenone, pentahydroxybenzophenone, phenol, naphthol, p-methoxyphenol, bisphenol A, pyrocatechol, pyrogallol, pyrogallol methyl ether, gallic acid, α , α ', α "-tris(4-hydroxyphenyl)-1,3,5-triisopropylbenzene, tris (hydroxyphenyl)methane, etc. and, as the amino group-having compound, there are illustrated aniline, p-aminodiphenylamine, etc. These quinonediazide sensitizers may be used alone or as a mixture of two or more of them. In addition, as the quinonediazidesulfonic acid esters, esters between a polycondensation product of a phenol and an aldehyde or ketone and the quinonediazidesulfonic acid may also be used.

The ratio of the above-described quinonediazide compound to the alkali-soluble resin to be used varies depending

upon the kinds of actually used quinonediazide compound and alkali-soluble resin but, in general, it is in the range of from 1:1 to 1:20, though the present invention not being limited thereto.

Chemically amplified resists are also preferably used in the present invention as the radiation sensitive materials. The chemically amplified resists generate acid upon being irradiated with radiation, and this acid in turn catalyzes chemical change in the radiation-exposed areas to change solubility of the areas for a developer solution, thus a pattern being formed. For example, there are illustrated those which contain an acid-generating agent capable of generating an acid upon being exposed to radiation and a resin having an acid-labile group capable of being decomposed in the presence of an acid to produce an alkali-soluble group such as a phenolic hydroxyl group or a carboxyl group.

As the acid generating agent capable of generating acid upon being exposed to radiation, there are illustrated bis-sulfonyldiazomethanes such as bis(isopropylsulfonyl) diazomethane, etc., bissulfonylmethanes such as methylsulfonyl p-toluenesulfonylmethane, etc., sulfonylcarbonyl diazomethanes such as cyclohexylsulfonyl cyclohexylcarbonyl diazomethane, etc., sulfonylcarbonylalkanes such as 2-methyl-2-(4-methylphenylsulfonyl)propiophenone, etc., nitrobenzylsulfonates such as 2-nitrobenzyl p-toluenesulfonate, etc., alkyl or aryl sulfonates such as pyrogallol trismethane sulfonate, etc., benzoin sulfonates such as benzointosylate, etc., N-sulfonyloxyimides such as N-(trifluoromethylsulfonyloxy)phthalimide, etc., pyrrolidones such as (4-fluorobenzenesulfonyloxy)-3,4,6-trimethyl-2-pyridone, etc., sulfonic acid esters such as 2,2,2-trifluoro-1-trifluoromethyl-1-(3-vinylphenyl)ethyl 4-chlorobenzene sulfonate, etc., and onium salts such as triphenylsulfoniummethane sulfonate, etc. These compounds may be used alone or in combination of two or more.

The resin having an acid-labile group capable of being decomposed into an alkali-soluble group such as a phenolic hydroxyl group or a carboxyl group in the presence of an acid comprises an acid-labile group capable of being decomposed in the presence of an acid and an alkali-soluble resin moiety. As the acid-labile group, there are illustrated, for example, a 1-substituted ethyl group such as a 1-methoxyethyl group, a 1-benzyloxyethyl group, etc., a 1-branched alkyl group such as a t-butyl group, etc., a silyl group such as a trimethylsilyl group, etc., a germyl group such as a trimethylgermyl group, etc., an alkoxycarbonyl group such as a t-butoxycarbonyl group, etc., an acyl group such as an acetyl group, etc. and a cyclic acid-decomposable group such as a tetrahydropyranyl group, a tetrahydrofuranyl group, a tetrahydrothiopyranyl group, a tetrahydrothiofuranyl group, etc. Of these acid-decomposable groups, t-butyl group, benzyl group, t-butoxycarbonyl group, tetrahydropyranyl group, tetrahydrofuranyl group, tetrahydrothiopyranyl group, tetrahydrothiofuranyl group, etc. are preferred.

As the alkali-soluble resin having alkali-soluble group such as phenolic hydroxyl group or carboxyl group, there are illustrated, for example, homopolymers or copolymers of vinyl monomers such as hydroxystyrene, hydroxy- α -methylstyrene, hydroxymethylstyrene, vinylbenzoic acid, carboxymethylstyrene, carboxymethoxystyrene, acrylic acid, methacrylic acid, crotonic acid, maleicacid, itaconicacid, citraconicacid, mesaconicacid, cinnamic acid, etc., copolymers of at least one of these monomers and other monomers, and polycondensation resins such as novolak resin.

In addition, as the chemically amplified resists, there are known different types which contain an alkali-soluble resin, an acid generating agent, and a compound capable of being decomposed in the presence of an acid to decrease the controlled solubility, or increase solubility of the alkali-soluble resin. Chemically amplified resists of this type can also be used in the present invention.

Further, known or well known various components such as sensitizers, surfactants, etc. may optionally be added to the radiation sensitive composition of the present invention.

The amount of a mixed solvent as containing 20 % by weight or less of at least one selected from propylene glycol and dipropylene glycol to the resist varies depending upon the kind of resist used and the kinds of solvents but, usually, it ranges from 50 to 3,000 parts by weight, preferably from 70 to 2,000 parts by weight, more preferably from 100 to 1,000 parts by weight, per 100 parts by weight of resist solid components.

The radiation sensitive composition of the present invention adapted for roller coating is prepared by dissolving a radiation sensitive material, and if necessary optional various components in the aforementioned solvent and, if necessary. filtering the resulting solution. The thus prepared composition is coated on a substrate such as a liquid crystal display substrate using a roller coater in a prebaked thickness of usually 1.0 to 2.5 μm. The composition coated on the substrate is then prebaked, for example, on a hot plate to remove the solvent and form a radiation sensitive resist layer. Prebaking temperature varies depending upon the kind of solvent or radiation sensitive material used but, usually, prebaking is conducted at between about 30 to about 200°C, preferably about 50 to 150°C.

After formation of the resist layer, exposure is conducted. The exposure is conducted using a known exposing apparatus such as a high pressure mercury lamp, a metal halide lamp, a super-high pressure mercury lamp, a KrF excimer laser, a soft X-ray beam generator, an electron beam writer, or the like optionally through a mask. After the patternwise exposure, the exposed resist layer is optionally subjected to post exposure baking for improving developability, resolving power, pattern profile, etc., and is developed. After the development, dry etching may optionally be conducted by using, for example, gas plasma for removing an anti-reflective coating or the like to create a resist pattern.

Development of the above-described resist is usually conducted by using a developer solution utilizing difference in solubility for a solvent or an alkali solution between exposed areas and unexposed areas. As an alkaline developer

solution, a water solution or an aqueous solution of an inorganic alkali (e.g., sodium hydroxide, potassium hydroxide, sodium carbonate, sodium silicate, etc.), an amine (e.g., ammonia, ethylamine, diethylamine, triethylamine, diethylethanolamine, triethanolamine, benzylamine, etc.), an amide (e.g., formamide, etc.), a quaternary ammonium salt (e.g., tetramethylammonium hydroxide (TMAH), tetraethylammonium hydroxide, cholin , etc.), a cyclic amine (e.g., pyrrole, piperadine, etc.) or the like is used.

The present invention is now described in more detail by reference to Examples and Comparative Examples which, however, are not construed to be limitative at all.

Examples 1 to 5 and Comparative Example 1

A polycondensation product (novolak resin) between m-cresol/p-cresol (6/4) and formaldehyde and a condensation product (quinonediazide photosensitizer) between 2,3,4-trihydroxybenzophenone and 1,2-naphthoquinonediazide-5-sulfonyl chloride were used, as a radiation sensitive material, in a proportion of 100:20 by weight and, after dissolving the material in various solvents shown in Table 1 to prepare solutions of 30 cP in viscosity. Each solution was coated on a Cr-layered glass substrate (300 x 360 x 1.1 mm) in a prebaked thickness of 1.5 μm using a roller coater, RC-353-P, made by Dainippon Screen Seizou Kabushiki Kaisha. After coating, the substrates were subjected to prebaking (proximity: 100 seconds; direct: 100 seconds) on a direct hot plate at 100°C. Viewing of the thus prebaked substrates under a sodium lamp (yellow lamp) gave the results shown in Table 1. Additionally, coating properties and drying properties in Table 2 were evaluated according to the following evaluation criteria.

Coating properties:

A: No unevenness in coating thickness was observed, and no difference in brightness was observed when viewed as a liquid crystal display element under the yellow lamp.
B: Unevenness in coating thickness was scarcely observed, and no difference in brightness was observed when viewed as a liquid crystal display element under the yellow lamp.
C: Unevenness in coating thickness was observed, and difference in brightness was visually detected when viewed as a liquid crystal display element under the yellow lamp.
D: Unevenness and roughness in coating thickness was observed, and difference in brightness was clearly detected when viewed as a liquid crystal display element under the yellow lamp.

Drying properties:

A: Drying was completed within a time 1.2 times as much as the standard time required for drying a coating containing PGMEA as a solvent.
B: Drying was completed within a time 1.5 times as much as the standard time required for drying a coating containing PGMEA as a solvent.
C: Drying was completed within a time 2 times as much as the standard time required for drying a coating containing PGMEA as a solvent.
D: Drying was completed only after a time 2 times as much as the standard time required for drying a coating containing PGMEA as a solvent.

Additionally, % in the following tables means % by weight.

Table 1

	main solvent	additive solvent	Coating Properties	Drying Properties
Example 1	PGMEA 80%	PG 20%	A	C
Example 2	PGMEA 83%	PG 17%	B	B
Example 3	PGMEA 85%	PG 15%	B	B
Example 4	PGMEA 87%	PG 13%	B	B
Example 5	PGMEA 90%	PG 10%	B	B
Comparative Example 1	PGMEA 100%	PG 0%	D	A

It can be seen from Table 1 that coating properties can be improved markedly by adding propylene glycol(PG) into propylene glycol monomethyl ether acetate (PGMEA). The coating property becomes better as the content of PG is increased, but drying property drops slightly down. In addition, in case the contents of PG are beyond 20 % by weight, the coating layer becomes markedly clouded, so it is not practical.

Examples 6 to 8 and Comparative Example 2

The same procedures as in Example 1 were conducted except for using as the solvent those shown in Table 2. Thus, there were obtained the results shown in Table 2.

Table 2

	main solvent	additive solvent	Coating Properties	Drying Properties
Example 6	EGA 83%	PG 17%	B	C
Example 7	EGA 85%	PG 15%	B	C
Example 8	EGA 87%	PG 13%	B	B
Comparative Example 2	EGA 100%	PG 0%	D	B

It is seen from Table 2 that coating properties can be increasingly improved by addition of propylene glycol (PG) to ethylene glycol monomethyl ether acetate (PGMEA). The coating property becomes better as the content of PG is increased, but drying property drops slightly down.

Examples 9 to 11

The same procedures as in Example 1 were conducted except for using as the solvent those shown in Table 3. Thus, there were obtained the results shown in Table 3.

Table 3

	main solvent	additive solvent	Coating Properties	Drying Properties
Example 9	PGMEA 80%	DPG 20%	B	B
Example 10	PGMEA 85%	DPG 15%	B	B
Example 11	PGMEA 90%	DPG 10%	B	B

It is seen from Table 3 that coating properties can be increasingly improved by addition of dipropylene glycol (DPG) into propylene glycol monomethyl ether acetate (PGMEA).

Examples 12 to 16

The same procedures as in Example 1 were conducted except for using as the solvent those shown in Table 4. Thus, there were obtained the results shown in Table 4.

Table 4

	main solvent		additive solvent	Drying Properties	Coating Properties
Example 15	EGA 50%	PtB 40%	PG 10%	B	B
Example 16	EGA 47.5%	PtB 40%	PG 12.5%	A	C
Example 17	EGA 50%	EL 40%	PG 10%	A	B
Example 15	EGA 47.5%	EL 40%	PG 12.5%	A	C
Example 16	EGA 30%	EL 62.5%	PG 7.5%	A	B

Coating property can also be improved by using mixed solvent as main solvent. It is seen from Table 4 that excellent coating properties and good drying properties can be obtained by using mixed solvents as comprising ethylene glycol monoethyl acetate (EGA) and propylene glycol t-butyl ether (PtB) or ethylene glycol monoethyl acetate (EGA) and ethyl lactate(EL).

Additionally, though drying properties generally tend to be deteriorated with the improvement of coating properties as is seen from the above results, it does not spoil industrial utility. For example, in using these radiation sensitive compositions for manufacturing liquid crystal display elements, difference in brightness is decreased owing to improved coating properties in spite of slight deterioration of drying properties, thus products with extremely high quality being obtained. Therefore, in actual manufacturing, it suffices to select solvent formulation taking the balance between coating properties and drying properties into consideration.

As has been described hereinbefore, the present invention provides a remarkable advantage that a coating layer can be formed with no coating unevenness by coating a radiation sensitive composition on a substrate, said composition containing 20 % by weight or less of propylene glycol and/or dipropylene glycol as one component of mixed solvent.

In addition, since no coating unevenness takes place when the radiation sensitive composition of the present invention is used, there is provided another marked advantage that liquid crystal element displays with high quality which do not present uneven brightness can be manufactured using a roller coater.

While the invention has been described above with reference to specific embodiments thereof, it is apparent that many changes, modifications, and variations can be made without departing from the inventive concept disclosed herein. Accordingly, it is intended to embrace all such changes, modifications, and variations that fall within the spirit and broad scope of the appended claims.

Claims

1. A radiation sensitive composition adapted for roller coating, in which a mixed solvent containing 20 % by weight or less of propylene glycol and/or dipropylene glycol to whole solvent is used as a solvent.

2. The radiation sensitive composition adapted for roller coating described in claim 1, wherein a solvent other than propylene glycol and dipropylene glycol is at least one selected from among propylene glycol monomethyl ether acetate, propylene glycol monomethyl ether, ethylene glycol monoethyl ether acetate, propylene glycol t-butyl ether, and ethyl lactate.

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EUROPEAN SEARCH REPORT

Application Number
EP 97 12 2389

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 558 272 A (MORTON INTERNATIONAL, INC.) * page 6; example 2 *	1,2	G03F7/004
X	GB 1 324 548 A (E.I. DU PONT DE NEMOURS AND COMPANY) * page 5; example 7 *	1	
A	DATABASE WPI Section Ch, Week 8735 Derwent Publications Ltd., London, GB; Class A89, AN 87-246639 XP002057108 & JP 62 169 163 A (FUJI PHOTO FILM CO LTD), 25 July 1987 * abstract *	1,2	
A	EP 0 536 086 A (CIBA-GEIGY AG) * page 12; example 26; table 5 *	1,2	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	DE 37 05 342 A (FUJI PHOTO FILM CO.,LTD.) * page 2, line 38 * * page 10, line 36 *	1,2	G03F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 February 1998	Dupart, J.-M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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